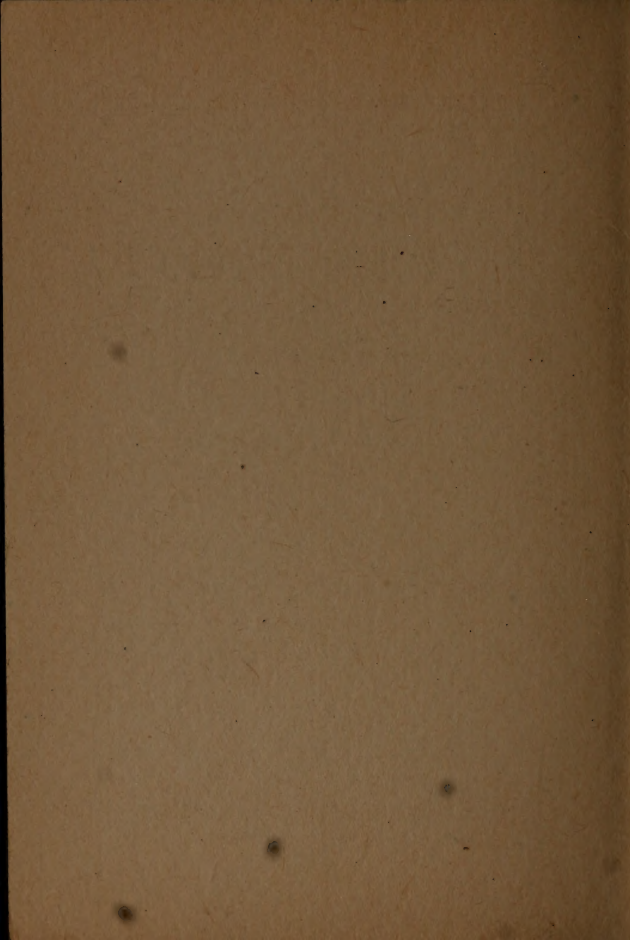


LITTLE BLUE BOOK NO. 885
Edited by E. Haldeman-Julius

Interesting Facts About How Spiders Live

Vance Randolph



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How To Know The Spiders

Vance Randolph

Drawings by Peter Quinn

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HOW TO KNOW THE SPIDERS

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INTRODUCTION

American spiders, with a few notable exceptions, are rather small and inconspicuous, and therefore have not attracted as much popular interest as the gayly colored birds and butterflies. Another reason for the spiders' unpopularity is the persistent notion that most of them are poisonous, a view which is very slenderly supported by experimental investigation. Still another is the fact that they are more difficult to classify than their relatives among the insects—the butterflies, for example—largely by reason of the lack of popular and adequately illustrated books about them. The books on American spiders are few and far between, and are either very ponderous and expensive textbooks, or learned monographs published by the various scientific societies, and read only by a few specialists.

The best popular book available is *The Common Spiders of the United States*, by James H. Emerton, published at Boston in 1902. Emerton describes all of the commonest, largest and most conspicuous species to be found north of Georgia and east of the Rockies—a large number of these, of course, occurring also in the Southern and Western States. Much of the material in this booklet is taken directly from Emerton's work. One of the best of the larger books is the manual by John Henry Comstock, but it is burdened with keys for classification

and other material which the general reader can get along without.

The body of a true insect, such as a beetle or a butterfly, is divided by constrictions into three parts, the head, the thorax and the abdomen. In the spider, however, the head and thorax have grown together, forming the segment called the cephalothorax. The head part of the cephalothorax usually bears eight simple eyes, which differs in size and arrangement in different species. Spiders have no large compound eyes like those of insects; their visual powers do not seem to be very highly developed, and probably two medium-sized spiders cannot see each other at a distance of more than four or five inches. At the sides of the head is a pair of palpi, like short legs, each with a wide flattened basal joint called a maxilla, which functions as an auxiliary jaw. Just above these are the true jaws or mandibles—stout, pointed organs with small holes at the tips, which are connected with the poison apparatus. The spider's poison is powerful enough to kill small insects, but it is very rarely dangerous or even excessively painful to man, and spiders seldom bite men anyway. I have handled hundreds of spiders, and have never yet been bitten. Spiders never chew their food, but merely hold it in the mouth while they suck the juices out of it.

The thoracic part of the cephalothorax bears four pairs of legs, and each leg has seven joints. The thick part next the body is the coxa; the next joint is very short, and is known as the trochanter; the third joint, the longest

in the entire leg, is the femur; next comes the patella, followed by the tibia, the metatarsus, and the tarsus or foot, the latter bearing two or three claws. On the lower side of the thorax between the legs, is an oval plate called the sternum.

The abdomen or hinder part of the body is connected with the cephalothorax by a slender stem, and contains the larger part of the alimentary canal, ending at the anal opening, and also the breathing apparatus. Air is drawn into the body through openings near the tip of the abdomen, and also through two slits near its base, which open into the pulmonary sacs or lungs. True insects, it will be recalled, have no lungs, but breathe through air-tubes which bring the air into direct contact with the cells which need it.

The external reproductive organs are located just between the air-slits, and are covered in the female by a complicated structure called the epigynum. The adult male spider is recognized by the enlarged terminal point of the palpi, with which he transfers the sperm from his own sexual opening to that of the female. Many spiders are inclined to cannibalism, and as the female of the species is not only deadlier but much larger than the male, his love-making is always more or less hazardous. The courtship is curious to say the least, and the diminutive suitor is frequently seized and devoured, either before or after the sexual act has occurred. For obvious reasons, most of the adult spiders one sees are females.

The silk-spinning apparatus consists of a

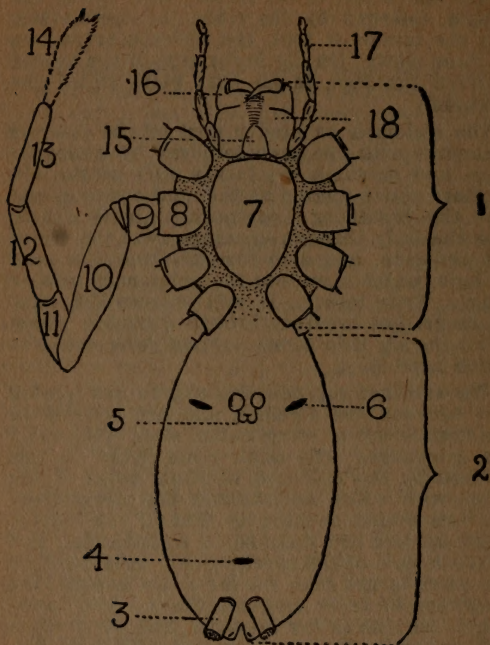


Diagram showing the external anatomy of a spider. 1, cephalothorax; 2, abdomen; 3, spinnerets; 4, trachea; 5, epigynum; 6, opening of air-sac; 7, sternum; 8, coxa; 9, trochanter; 10, femur; 11, patella; 12, tibia; 13, metatarsus; 14, tarsus; 15, labium; 16, mandible; 17, palpus; 18, maxillae. (Adapted from Emerton.)

reservoir of liquid silk inside the abdomen, and two or three pairs of little organs called spinnerets, situated on the under side of the abdomen near the tip. Each spinneret is pierced by a great number of very small holes through which the liquid passes out into the air, where it instantly hardens into silk. The spinnerets are movable and sometimes jointed, so that the spider can spread them apart and spin a loose silk ribbon, or draw them together so as to combine all the little threads into a single stout cable. Nearly all spiders can spin silk, but many do not construct webs with it. Some species use it only to line their nests, or to build protective sacs about their eggs, or even to support themselves balloon-fashion in the air. The amount of silk which the individual spider can produce is limited, and when a web-builder cannot spin any more he is in a serious predicament, and there is nothing for it but to fight some younger relative for his web.

Many spiders enclose their eggs in a silken sac, which varies in size, shape and color according to the species. Some spiders carry the egg-sac about with them, either in the mandibles or attached to the spinnerets; others leave it in the nest or web, while still others fasten the sac to the branch of a tree or the under side of a stone. The young spiders do not come out of the sac until they are able to run about freely, and usually remain clustered together for some time. In some species the young remain in a common web or nest, while in others the whole brood rides about upon the mother's back. Adult spiders are not gregari-

ous, however, and live either alone or in pairs. Different species breed at different seasons, but most of them live only one year, and pass the winter as eggs or very young spiders. Some species, according to Cragin, have been known to live as long as four years. A few spiders are many-brooded, and both young and adults may be found at all seasons.

Spiders are regarded as insects by most casual observers, but a close examination shows that they have eight legs where the true insect can only show six, and that they are provided with lung-like respiratory sacs instead of the air-tubes characteristic of the Insecta. Spiders are classified in a group called the Arachnidae, which includes also the ticks, mites, scorpions, and other forms which differ greatly in size and habits. The spiders proper are placed in the order Araneida, which may be divided for convenience into two groups, the distinction being based upon the food-getting behavior of their members. The hunting spiders run about on the ground or upon plants, catching their prey wherever they can find it; the cobweb spiders build webs and wait for their prey to come to them. The order Araneida is still further divided into a number of families. Authorities differ somewhat, but the classification used by Emerton is probably as good as any.

Emerton considers the hunting spiders in five groups: (1) the Dysderidae, a few species with six eyes only and with four breathing holes at the front end of the abdomen; (2) the Drassidae or ground spiders, which live among stones, dead leaves or plants, making tubular nests and flat egg sacs but no cobwebs; (3)

the Thomisidae, the flat and crab-like spiders living on plants or under bark and stones; (4) the Attidae or jumping spiders, with wide heads and large front eyes, many of them brightly colored and active in their habits; (5) the Lycosidae, the long-legged running spiders, living on the ground. A few of the Lycosids live in holes and carry their round egg-sacs about attached to their spinnerets.

There are five families among the cobweb spiders also: (1) the Agalenidae, which make flat webs on grass or in corners of houses, with a tube at one side in which the spider lives; (2) the Therididae, round spiders with flat or irregular webs in corners and on plants; (3) the Linyphiidae, the small spiders which build flat webs near the ground in shady places; (4) the Epeiridae, the round-web spiders; (5) the Cini-flonidae, which have a row of hairs on their hind legs, and build the loose, rough webs that gather dust.

Each one of these ten families is divided into several subfamilies, genera and species, the names of the two latter being used to designate any particular specimen. Among birds and butterflies one may avoid the formidable scientific nomenclature, as these creatures have acquired popular names also, but this is not the case in the Araneida.

The collector of spiders has no occasion to burden himself with insect-nets and carrying-cases and cyanide jars as the butterfly-hunter does, but needs only two or three small wide-mouthed vials in his pocket. Thus equipped he fares forth to search in old gardens and

fence corners, among bushes, and under stones and sticks lying on the ground. Some of the best places are along the edges of woods, and one of the best methods of search is the still-hunt—one simply sits down and keeps his eyes open. The cobweb spiders may be found at any time, but hunting spiders are more active toward the warmer part of the day. Spiders may be kept in captivity for some time. They require very little air or food, but must have a little water every day or so. The collector who wishes to kill his specimens has only to drop them into a bottle of alcohol or gasoline.

Spiders cannot be pinned and dried like butterflies or beetles, and many spider enthusiasts make no attempt to preserve their specimens, but prefer to record their labors in the form of photographs, drawings and notes. If one wishes to make a permanent collection he must keep his specimens in alcohol, formalin or some other preservative fluid. Formalin hardens the specimens and make them brittle, but diluted alcohol works very well, and I am told that the post-Volstead variety is as good as any. I have seen some beautiful specimens in glycerin, but they are said to be too brittle to permit of much handling. A few of the larger species are sometimes skinned out and stuffed, but this is a delicate operation, and hardly worth bothering with. The ordinary amateur had best keep his specimens in such alcoholic fluids as are available. Much of the cheap liquor sold nowadays is quite unfit for human consumption, but serves well enough to pickle spiders in.



Two typical Drassids. A, *Poecilochroa variegata*, female. B, *Geotrecha crocata*, female.

HOW TO KNOW THE SPIDERS

THE DRASSIDAE

These are the dull-colored, long-bodied, stout-legged running spiders often seen skipping about over dead leaves and short grass. Some species are found under stones in the day-time, and come out for their hunting expeditions only at night. They build no webs, but make tube-shaped nests in or on the ground, where the egg-sac is usually deposited. The Drassids are generally about three times as long as they are wide, the body has a more or less flattened appearance, and the legs are all practically the same length. The first two pairs point forward, while the third and fourth pairs are directed to the rear. The short hair gives the legs and body a sleek, mouse-like appearance, and each foot is provided with two claws. The eight eyes are all about the same size, arranged in two fairly even rows, and the mandibles are usually large and strong.

Gnaphosa conspersa is a little rusty black fellow about half an inch long, which lives under stones in most of the Eastern and Middle Western States. Emerton describes it as follows: "The cephalothorax and abdomen are about the same size and a little flattened. The legs are stout and all nearly the same length. The upper row of eyes is nearly straight and the lateral eyes much farther from the middle pair than these are from each other. The mid-

dle eyes are oval and oblique, diverging toward the front. The maxillae are large and rounded on the outer corners. The mandibles are large and strong, with a wide, flat, serrated tooth under the claw. The cocoon is white and flat, with a diameter as great as the length of the spider. The female, as far as I have observed, makes no nest, but partly lines with silk a shallow hole, in which she nurses her cocoon."

Poecilochroa variegata is only about a quarter of an inch in length, but it is one of the few brilliantly marked Drassids that we have. The cephalothorax is dull orange, and the legs are orange too, except for the femora of the first and second pairs, which are black. The abdomen is black with two white stripes around it, and a T-shaped white mark between them. The two rows of eyes are almost straight, and the upper row is a little longer than the lower.

Drassus saccatus is nearly an inch in length, and is pale gray without any conspicuous markings. This spider lives under large stones or logs, and spins a transparent sac in which the eggs are deposited. Male and female are often found together in the nest, and the female does not leave the egg-sac until the young have emerged. Emerton describes this species in some detail: "The head is shorter and wider than in *Gnaphosa conspersa*, and the eyes cover a larger part of the head. Both rows of eyes are curved, with the middle highest. The middle upper pair are oval and turned apart toward the front. The lateral eyes are twice their diameter from the middle pair. The maxillae are widened at the ends on both sides. The

labium is as wide as it is long, narrowed toward the end but truncated at the tip. The color is light gray, with short fine hairs all over the body. The front of the head, the feet, and the mandibles and maxillae are darker and browner. The abdomen is marked only with the usual four muscular spots and sometimes a few transverse dark markings toward the hinder end. The legs are long and tapering in both sexes. The male is smaller and more slender than the female, and the male palpi are long, with the ends very little enlarged."

Geotrecha crocata is a scant half an inch long. The general color is very dark brown or black, but the four outer segments of the legs and palpi are light brown or yellowish, and there is a bright red spot at the end of the abdomen. The spinnerets are located well under the body, and can scarcely be seen from above. This species is very active, and may be seen scuttling about among stones in warm, dry, open places. The egg-sac is flat and silvery-white, and is usually fastened to a stone.

Clubonia crassipalpis is a pale little spider about a quarter of an inch in length, which makes its summer nest of silk and rolled leaves fastened to a bush, and spends the winter in a tubular nest in the ground, or under the bark of a tree. The eyes are unusually close to the front of the head. There are no noticeable markings on the body, but the head, mandibles and the ends of the male palpi are always the darkest parts. The body appears shorter than in the preceding species, and the legs are unusually long and slender.

Chiracanthium viride is much like the preceding species in general appearance, but the color is greenish white, and there is a small dark longitudinal stripe in the upper middle of the abdomen. The legs are all rather long, and the first pair noticeably longer than any of the others, particularly in the male, where they are nearly three times as long as the body. The body is shorter than that of *Clubonia crassipalpis*, and the abdomen somewhat broader and thicker in the middle. The eye-arrangement is very similar, as are the mouth-parts, but the sternum is shorter and more rounded. The upper spinnerets consist of two joints, and are considerably larger than the lower pair.

THE DYSDERIDAE

These spiders resemble the Drassidae, but have only six eyes instead of eight. Another important difference is that the openings into the air-tubes are located in the front part of the abdomen near the slits leading to the pulmonary sacs. In the Drassidae, as in most other spiders, the air-tubes open near the tip of the abdomen, just anterior to the spinnerets.

Dysdera interrita is about half an inch long, with a light brown cephalothorax and legs, and a whitish abdomen. The six eyes are set close together, almost forming a circle on the front of the head. The mandibles are unusually long and inclined forward. The two air-tube openings are seen just behind the lung-slits.

Ariadne bicolor is a little smaller than the preceding species, and very similar in appear-

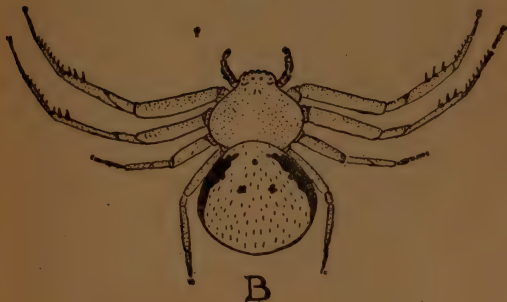
ance, but the abdomen has a slightly purple cast. The cephalothorax and abdomen are about the same size, and the head is unusually wide, with long narrow maxillae. The first pair of legs is stoutest and longest, and the first three pairs are pointed forward.

THE THOMISIDAE

The members of this family are known as crab-spiders, because their bodies are short and wide, the legs are spread out sidewise like those of a crab, and they often move sidewise or backwards in preference to going straight ahead. The eyes are rather small, and are set in two rows, the front one usually the shortest. These crab-spiders search for their prey over small areas, or lie in ambush for small insects. They do not spin webs, but often suspend themselves by a thread in times of danger.

Misumena vatia is the common crab-spider found on flowers, where it lies in wait for insects which come for the nectar. The mature female is about half an inch long, while the male is usually little more than an eighth of an inch long. The body is white, shading into yellow on the sides of the thorax. In both sexes there are sometimes a few red spots about the face, and on the sides of the abdomen.

Misumena asperata is not quite as large as *vatia*, and there is less difference in size between the sexes. It is recognized also by the hairy appearance of the body and legs. Emerton's description of this species is as follows:



Misumena vatia, a common Thomisid, or Crab Spider. A, male; B, adult female.

"The adult females are always pale and sometimes white, but seldom lose entirely the reddish bands around the legs. Both sexes are covered with short stiff hairs about their length apart all over the upper part of their body and legs. The usual color is pale yellow, with dull red markings. The thorax is reddish at the sides. The abdomen has two red bands or rows of spots on the hinder half, meeting behind. In front are a middle pair of spots and two side bands that spread apart in the middle and meet again at the spinnerets. The tibia and tarsus of the front legs are marked with a narrow red ring at the base and a wider ring near the end of each joint. The female is a quarter of an inch long and the male about half that length. The markings of the male are like those of the female, but the spots are larger and more deeply colored."

Synema parvula is another common crab-spider found upon flowers. The female is about an eighth of an inch long, and the male is nearly as large. The body is stouter and rounder than in most spiders of this type, both the cephalothorax and abdomen being as wide as they are long. The general color of the thorax is orange, with a light circle about the eyes and a dark streak on either side. The abdomen is yellowish white, with a wide brown band across the hind part in front of the spinnerets. This species is very abundant in some parts of the South.

Xysticus limbatus does not frequent flowers, but may usually be found under leaves or other objects on the ground, and sometimes lives un-



A



B

Maevia vittata. A, male (dark form) ; B, female.

der the bark of trees. About one-third of an inch in length, the body is stocky, hairy and light brown in color, with darker markings. The legs are conspicuously stout and short.

Xysticus triguttatus is common on grass and weeds everywhere in the United States. The two sexes are nearly the same size (about one-fifth of an inch long) but the abdomen of the female is much larger than that of her mate. The female is light yellow with brownish legs, and black spots and markings upon both thorax and abdomen. The male is darker, with a light area in the middle of the thorax, and black and white bands on the abdomen. The inner joints of the first and second legs are dark brown.

Philodromus vulgaris is the little gray-brown crab-spider so common about houses, barns and fences. Seen resting on a weather-beaten board, its resemblance to the background is astonishing, and is one of our best examples of protective coloration. The body is not more than a quarter of an inch in length, but the slender legs are so long, particularly in the male, that the total tip-to-tip measure is an inch and a quarter. The entire body is covered with fine hairs, which in the male at least give a peculiar iridescent effect. The pointed abdomen is darker at the edges, and the legs and thorax somewhat spotted with different shades of gray.

THE ATTIDAE

These are the jumping spiders so common about old wood-piles and among the tops of black spots and markings upon both thorax and

thick, and two of the eight eyes are very much larger than the others. Two pairs of legs are directed forward and two backward. The first pair is usually longest, and is generally thickest in the males. The more common Attidae are gray or black, but some species are brightly colored. They seem to walk sideways or backward quite as well as forward, and capture their prey by springing upon it from a distance. As Cragin says: "If a careless fly or bug alights near one of them, he does not jump directly at it, but backs slowly away, not to alarm it, until he is out of sight over the edge of the board or sill. Then he runs along to a point just opposite the fly, fastens a thread to anchor by, and makes a quick, strong spring. If the insect is large enough it will often fly away and take the spider with it, but his thread holds them, and the poison from his bite soon weakens the victim so that he is able to conquer it." The Attids do not spin webs, but some varieties build silken tubes in which they lay their eggs and sometimes pass the winter.

Habrocestum auratum is thickly covered with hairs which give it a light gray color, and the male has several distinct white stripes on the cephalothorax and abdomen. The front legs of the male are fantastically ornamented with tufts of black and white hair—evidently sexual decorations. Emerton describes the courting behavior as follows "At the mating time the males, as they approach the females, hold the front legs extended sidewise and lifted a little from the ground, with the tibia nearly horizontal and the tarsus turned downward. In



A



B

Habrocestum auratum, a typical representative of the Attidae, or Jumping Spiders. A, male; B, female.

this position they advance slowly, at the same time running rapidly sidewise from one side to the other and at short intervals jerking the abdomen and the front legs slightly upward. They go almost close enough to touch the female and then quickly retreat."

Habrocestum spendens is only about a quarter of an inch in length. The female is brown, with black and white markings. The male has an iridescent cephalothorax and a bright red abdomen. Peckham has observed the mating habits of this species, and says that as the male dances about before his mate he is careful to hold the abdomen in an almost vertical position, so that its brilliant coloring shows to good advantage.

Maevia vittata measures only about one-third of an inch, but its unusually long legs make it appear somewhat larger. The female is a translucent yellowish white, with a few dim gray or black markings, and some indistinct reddish lines on the abdomen. The front part of the cephalothorax is dark, and the eyes are black. The male of this species is dimorphic; some individuals look very much like the female, except that the palpi are bright orange color, and the body markings more distinct. The other male form has the whole body black, and the legs whitish and almost transparent. The palpi of the black male are black except for a few orange hairs, and there are three conspicuous bunches of long hair at the front of the head, one in the center and one on either side.

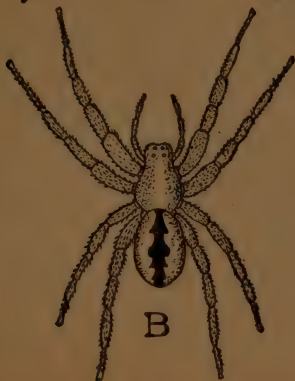
Synemosyna formica is about a quarter of an

inch in length, and looks so much like an ant that it ordinarily escapes the attention of the collector whose eyes are set for spiders. The general color is black or dark brown, with some indistinct yellowish markings. Very little is known of the habits of *formica*; it is quite able to jump as well as the other *Attidae*, but very rarely does so, spending most of its time running about ant-fashion, with the front legs held up so as to resemble an ant's antennae.

Lyssomanes viridis is the little green spider so common on bushes in many parts of the South. There are usually a few black spots on the abdomen. The female measures about a third of an inch in length, and the male is noticeably smaller. The mandibles in the male are unusually long—almost as long as the cephalothorax—and are extended forward horizontally.

THE LYCOSIDAE

Most of the large and medium-sized spiders seen on or near the ground belong to this family, and are usually brown, gray or black in color. The body is unusually long, and the abdomen rather massive; the legs are long and covered with hairs and spines. Some species live in holes in the ground, and nearly all of them carry their round egg-sacs about, either held in the mandibles or fastened to the spinnerets. Some species carry their newly-hatched offspring on their backs; others leave them all together in a loose silken nest on a weed or a low bush. The young are usually only about



Lycosa nidifex. A, male ; B, female.

half grown when cold weather sets in, and do not mature until the following Summer.

Lycosa nidifex is usually a trifle over half an inch in length, but its long legs give it a spread of more than two inches. The general color resembles that of the sand in which these creatures live, and the two front pairs of legs are thicker than the others, and closely covered with hair. The male has several black bands about the head and thorax, and the tips of the palpi are black. The female is similar, but has a variable brown stripe down the middle of the abdomen. The male may be found walking about on the sand, but the female lives in holes in the ground, which are often nearly a foot deep and are usually lined with silk. "The females," as Emerton says, "keep near their holes and drop into them at the least fright. As one walks across the neighborhood no spiders are to be seen, only open holes. After a short time they come to the surface, at first slowly, but sometimes, as they see the place clear, with a sudden jump, and stand over the hole ready to drop back into it."

Lycosa carolinensis is a very hairy mouse-colored spider with a body about an inch long, and long hairy legs which bring the tip-to-tip measurement up to three inches or more. The under side of both body and legs is black, and there are usually a few orange-colored hairs in front of the brown mandibles. The ends of the palpi and front legs in the male are sometimes tinged with yellow. The specimens seen on the surface of the ground in Summer are usually males, as the female spends most of

her time in the shallow burrow where the eggs are deposited.

Lycosa communis is about half an inch long, and varies in color from light to very dark gray, some individuals being nearly black. There is a light median stripe on the thorax, and the abdomen bears two stripes which join about one-third of the distance up from the tip. In dark-colored specimens these stripes are very distinct, and often have a yellowish color. There is not much difference between the sexes as regards either size or coloring. *Lycosa communis* is one of the commonest of the field-spiders, and the females may be seen carrying the egg-sac attached to the spinnerets any time between May and the first of August.

The great French naturalist Fabre has made very careful studies of *Lycosa narbonnensis*, a European species very similar to our own *Lycosa nidifex*. Fabre used to capture these creatures by using various kinds of insects as baits. "Procuring a supply of live bumble-bees," he says, "I put one into a little bottle with a mouth just wide enough to cover the opening of the spider's burrow; and I turn the apparatus thus baited over the said opening. The powerful bee at first flutters and hums about her glass prison; then perceiving a burrow similar to that of her family, she enters it without much hesitation. She is extremely ill-advised: while she goes down, the spider comes up, and the meeting takes place in the perpendicular passage. For a few moments, the ear perceives a sort of death-song: it is the humming of the bumble-bee, protesting against the reception given her. This is followed by a

long silence. Then I remove the bottle and dip a long-jawed forceps into the pit. I withdraw the bumble-bee, motionless, dead, with hanging proboscis. A terrible tragedy must have happened. The spider follows, refusing to let go so rich a booty. Game and huntress are brought to the orifice. Sometimes, mistrustful, the *Lycosa* goes in again; but we have only to leave the bumble-bee on the threshold of the door, or even a few inches away, to see her reappear, issue from her fortress and daringly recapture her prey."

Fabre and others have been astonished at the extreme rapidity with which the *Lycosa*'s poison works. "As soon as that shrill buzzing, which I have called the death-song, ceases, in vain I hasten to insert my forceps: I always bring out the insect dead, with limp legs and slack proboscis. Scarce a few quivers of those legs tell me that it is a quite recent corpse. The bumble bee's death is instantaneous. Each time that I take a fresh victim from the terrible slaughter-house, my surprise is renewed at its sudden immobility."

Fabre's further investigations showed that the spider's poison is always injected into the nerve centers at the nape of the neck; in a few instances the huntress missed this target, and the bee lived long enough to sting the spider to death. Most investigators have reported that the bite of this and other similar spiders is not dangerous to the higher animals, but Fabre's experiments do not support this view. "I make a tarantula (*Lycosa narbonnensis*) bite the leg of a young, well-fledged sparrow, ready to leave the nest. A drop of blood

flows; the wounded spot is surrounded by a reddish circle, changing to purple. The bird almost immediately loses the use of its leg, which drags, with the toes doubled in; it hops upon the other. Apart from this the patient does not seem to trouble much about his hurt; his appetite is good. My daughters feed him on flies, bread crumbs, apricot pulp. He is sure to get well, he will recover his strength; the poor victim of the curiosity of science will be restored to liberty. This is the wish, the intention of us all. Twelve hours later the hope of a cure increases, the invalid takes nourishment readily; he clamors for it if we keep him waiting. But the leg still drags. I set this down to a temporary paralysis which will soon disappear. Two days after, he refuses food. Wrapping himself in his stoicism and his rumpled feathers, the sparrow hunches into a ball, now motionless, now twitching; my girls take him in the hollow of their hands and warm him with their breath. The spasms become more frequent. A gasp proclaims that all is over. The bird is dead.

"There was a certain coolness among us at the evening meal. I read mute reproaches, because of my experiment, in the eyes of my home circle; I read an unspoken accusation of cruelty all around me. The death of the unfortunate sparrow had saddened the whole family. I myself was not without some remorse of conscience; the poor result achieved seemed to me too dearly bought. I am not made of the stuff of those who, without turning a hair, rip up live dogs to find out nothing in particular.

"Nevertheless, I had the courage to start afresh, this time on a mole caught ravaging a bed of lettuces. There was a danger lest my captive, with his famished stomach, should leave things in doubt if we had to keep him for a few days. He might die not of his wound, but of inanition, if I did not succeed in giving him suitable food, fairly plentiful and dispensed at fairly frequent intervals. In that case I ran a risk of ascribing to the poison what might well be the result of starvation. I must therefore begin by finding out if it was possible for me to keep the mole alive in captivity. The animal was put into a large receptacle from which it could not get out and fed on a varied diet of insects—beetles, grasshoppers and others—which it crunched up with an excellent appetite. Twenty-four hours of this regimen convinced me that the mole was making the best of the bill-of-fare and taking kindly to his captivity.

"I made the tarantula bite him at the tip of the snout. When replaced in his cage, the mole keeps on scratching his nose with his broad paws. The thing seems to burn, to itch. . . . About thirty-six hours after being bitten the mole dies during the night and certainly not from inanition, for there were still half a dozen live Cicadae in the receptacle, as well as a few beetles. . . . The bite of the black-bellied tarantula is therefore dangerous to other animals than insects: it is fatal to the sparrow, it is fatal to the mole. Up to what point are we to generalize? I do not know, because my inquiries extended no further. Nevertheless, judging from the little that I

saw, it appears to me that the bite of this spider is not an accident which man can afford to treat lightly. That is all I have to say to the doctors."

Dolomedes tenebrosus has a body nearly an inch long, and a total spread of more than four inches. The general color is light gray with variable darker markings, and there are usually three pairs of transverse black stripes on the abdomen. The male is more slender than the female, and his palpi are large and provided with a hooked tarsus. The female carries the egg-sac about in her mandibles, and when the eggs are nearly ready to hatch she spins a large, loose bunch of silk in a bush, and the young spiders live in this rude nest for several weeks after hatching. *Tenebrosus* is found in low vegetation or on the ground along the banks of streams, and rarely ventures very far from the water.

THE AGALENIDAE

These are the builders of the flat webs so common in grass, and which show up so prominently on dewey summer mornings. There is a funnel-shaped refuge at one side of the web where the spider is accustomed to rest, and from which it sallies forth when some insect falls into the spreading net. Many of the Agalenidae look like Drassids; most of them are brown with unusually long legs, two pairs being directed forward and two backward. The female mandibles are greatly swelled at the

base, and the upper spinnerets of both sexes are much longer than the lower pair.

Agalena naevia often spins its web in houses and outbuildings, and is common all over the United States. The males and females are about the same size—not more than three-fourths of an inch long—but they vary greatly in color. Some specimens are yellow or even reddish, but the commonest type is gray with two dark lines on the thorax and two broken rows of light spots on the abdomen. The male's legs are somewhat longer than those of the female, and his abdomen is more slender. The eggs are laid late in the fall in a flattened dirty-looking egg-sac, which is usually attached to a board in a fence-corner or to a bit of bark. The female spider remains with her eggs until she is frozen to death, and her shrivelled body may usually be found near the egg-sac. The young spiders hatch sometime during the winter, but do not eat any food or emerge from the sac until the first warm days of early spring, when they crawl out and build their tiny webs in the short grass. These webs are very thin, and are not adhesive; I have never seen an insect captured in one of them, and it is difficult to see how the young *naevia* ever gets food enough to keep it alive.

Tegenaria derharmii is a long-legged gray spider which builds the familiar shelf-like webs in the corners of cellars and deserted buildings. There is a funnel-shaped tube on one side as in the case of *Agalena naevia*, but because of their location the *derharmii* webs are usually ragged and dust-covered, and have a very different

appearance. The egg-sacs are similar to those constructed by other members of the family, and are generally fastened to the wall near the web.

THE THERIDIDAE

There are the small, soft, round-bodied spiders which build the large irregular webs in bushes, and sometimes in the upper corners of houses. There is no tube into which the owner can retreat, and it spends most of its time hanging belly-up in the center of the web, which it seldom leaves save in case of accident or attack. The round egg-sacs are usually fastened to the lower part of the web, and several broods are produced in a single season.

Theridium tepidariorum. This is a very common house spider in the Eastern States, and is also abundant about wood-piles and rocky ledges near human habitations. About one-quarter of an inch in length, the general body color is dirty gray or black, with yellowish blotches on the cephalothorax. The legs of the female are yellow, with brown rings; those of the male are bright orange, with darker areas at the ends of the joints. In some individuals there is a distinct black and white mark in the middle of the abdomen. The web is usually rather large, and if it is built out of doors the spider often drags a leaf into it, under which he conceals himself while in wait for prey.

Theridium rupicola is very similar to the preceding species, but only about one-half as large, and is distinguished by a peculiar projecting



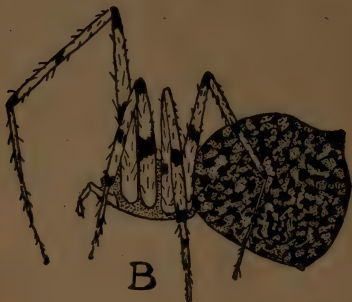
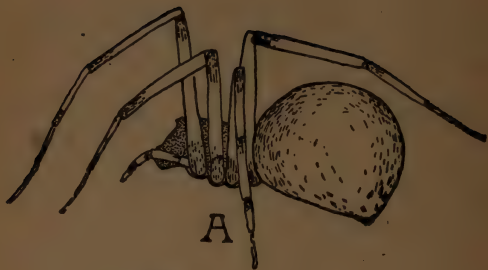
A, web of *Theridium tepidariorum*. B, *Latrodectus mactans*.

hump in the center of the abdomen. The webs are seldom found in houses or on plants, but are attached to stones in ledges or rock fences. Emerton points out that the grains of sand often found in the web must be placed there by the spider, since similar grains dropped into these flimsy structures pass through without sticking to the threads.

Theridium unimaculatum. This species is very small—seldom more than one-twelfth of an inch in length—and spins its web among small leaves on bushes. The legs and cephalothorax are orange colored, with a few black markings; the abdomen is white with a conspicuous black spot in the center.

Latrodectus mactans is often half-an-inch or so in length, and spins its flat sheet-like web on plants or among stones, although it is occasionally found in houses. The legs and body are black, with a blood-red spot on the under side of the abdomen. The male has some red and white spots upon the upper side of the abdomen also, and the young are like the male except that they have less black throughout. This species is in many places regarded as very poisonous, although there is absolutely no evidence that this is the case.

Argyrodes nephilae is a little black spider with a silvery white conical hump on the back of the abdomen, particularly large in the male. This species is often found dwelling unnoticed in the outer edges of large webs built by other spiders, although it is quite able to spin a web of its own when necessary.



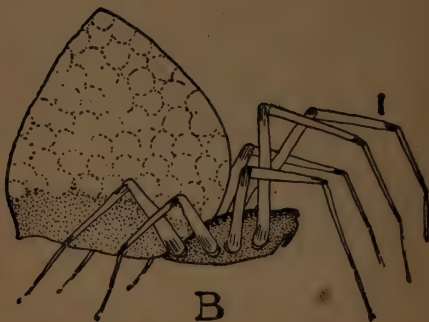
Two representatives of the Therididae. A, *Theridium tepidariorum*, female; B, *Theridium rupicola*.

Pholcus phalangioides has a body not more than a quarter of an inch in length, but its legs are so long that it spreads fully four inches and is often mistaken for the common "daddy long-legs," which is not a spider at all. It is common in most parts of America now, but was probably imported from Europe by the early colonists. Living mostly in dark garrets or cellars, it hangs head downward in a large loosely-constructed flat web. The egg-sac is fragile and transparent, and is usually carried in the mandibles.

THE LINYPHIADAE

This family includes a great number of small, dull colored spiders, found usually in low shrubbery, under leaves, and in caves and similar shelters. They are distinguished from the Therididae by the more slender body and stouter, spinier legs. The males of some species have large and curiously shaped palpi, and other distinguishing peculiarities of structure about the head. The webs are usually simple flat nets, with guy-wires and braces above and below, but several remarkable variations are known.

Erigone longipalpis is only a tenth of an inch long, and of an inconspicuous dark brown color, although the males are sometimes marked with orange about the legs and cephalothorax. These spiders are rather sluggish, and build small webs among fallen leaves and similar rubbish, where they usually escape the collector's eye. "At one season of the year, however," says



Argyrodes nephilae. A, male; B, adult female.

Emerton, "the *Erigones* appear in great numbers. This is during the fine weather that comes after the first frosts in October and November, when they, in company with the young of many large kinds of spiders, come to the tops of posts and fences and, turning their spinnerets upward, allow threads to be drawn out by ascending currents of air, until sometimes the spiders are lifted off their feet and carried long distances. Though not so easily seen, the same performance is going on at the tops of grass and bushes, and at times the whole country is covered with threads of silk, and the threads in the air tangle together into flakes, which at length fall, sometimes from great heights. This appearance is called in England *gossamer*, and in Germany the *flying summer* and the *old woman's summer*. Why the spiders spin the thread and what use it is to them to be blown about are unknown. At the time of the autumn flights great numbers of these spiders may be seen on fences and doorsteps in city streets wherever there is a neighboring park or grass plat, and the spiders probably live the rest of the year among this grass near the ground."

Erigone dentigera is difficult to distinguish from the preceding, and the same is true of several other members of the genus. *Erigone autumnalis* is the only one that is easily recognized—it is very light in color and the head is bright yellow.

Linyphia marginata is about one-sixth of an inch long, dully marked with yellow and purplish brown. It has no nest, but spends its



Epeira verrucosa. A, male ; B, female.

entire life hanging in a peculiar dome-shaped web. This singular net is unlike anything produced by the other members of the family, and it is worth while to quote Emerton's account of it:

"The web of *L. marginata* is in the form of a dome four or five inches in diameter, hung between rocks and plants, seldom much concealed by leaves. The threads are fine, and the web so transparent that it easily escapes notice unless the sun shines upon it. The depth and width of the dome depend somewhat upon the shape of the opening in which it is made, and the number and length of the supporting threads vary according to the surroundings. The spider stands apparently all the time under the top of the dome. Insects flying near touch the threads above the dome and, their flight being broken, drop down among closer threads and finally to the dome itself, where they are caught by the spider and taken through the meshes. Remains of insects and other rubbish are cut loose from the web and dropped. The webs seem to be used for a long time, but if they are injured a new one is soon made, either in the night or day, and the remains of several old webs are often seen hanging flat and torn below a new one. The dome is begun at the top and extended downward by inclined threads, an inch or two long, which are crossed by shorter threads in all directions. The spider works very rapidly, but I have never seen a dome finished, the spider always working a few minutes and then resting a long time."



Tetragnatha extensa, showing the characteristic attitude in the web at rest.

Linyphia phrygiana is somewhat larger than *marginata*. The cephalothorax is yellow with a black line down the middle of the back, and two shorter black lines at the sides. The legs are yellow with several dark bands and spots, and bear conspicuous black spines. The abdomen is yellowish, and there is usually a dark median stripe. The web of this species is often ten or twelve inches in diameter, and a corner of it, according to Emerton, "usually runs under a stone or some other hiding place, and here the spider stands, often making a little tent in connection with the web."

Linyphia socialis is about an eighth of an inch long, distinctly marked with black and white stripes and blotches. It is common all over the northern half of the United States, and is usually found in little flat webs, but many observers have noted it clinging to the bark of trees without any web at all.

THE EPEIRIDAE

The members of this family are the most conspicuous of the whole spider tribe, because they build the beautiful round cobwebs familiar to everybody. One of the spiders—usually the female—may always be found hanging head downward in the center of the web. When a flying insect strikes one of the sticky threads it begins to struggle, becomes further entangled, and shakes the whole structure. This arouses the spider, which rushes out and binds the victim fast with silk pulled out of the spinnerets. The construction of these

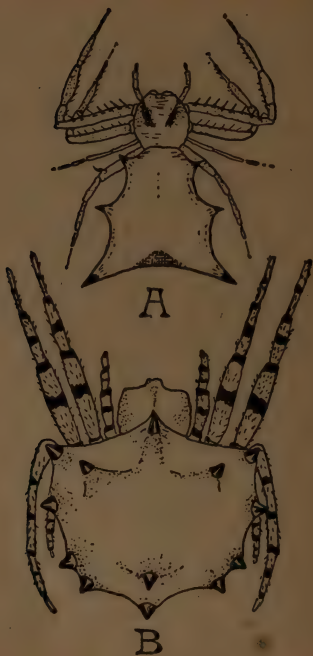


Epeira trifolium. A, male; B, female.

round webs is worthy of considerable attention, and we turn again to the indefatigable Emerton:

"The round webs of the Epeiridae consist of a number of radiating lines, varying in different species from a dozen to seventy, crossed by two spirals,—an inner spiral that begins in the center and winds outward, and an outer spiral that begins at the edge of the web and winds inward. The inner spiral is made of smooth thread like the rays, and dust will not stick to it. The outer spiral is made of more elastic and sticky thread, which, when it is fresh, is covered with fine drops of a sticky liquid. In the finished web the outer spiral covers three-quarters or more of the diameter and the inner spiral a quarter or less, but in the unfinished web, before the sticky thread is put in, the inner spiral covers nearly the whole of it and is cut out, piece by piece, to make room for the outer spiral.

"In beginning a web, after the radiating threads are finished, the spider fastens them more firmly at the center and corrects the distances between them by several short, irregular threads and then begins the inner spiral with the turns, at first close together and then widening, in some species gradually, in others suddenly, until they are as far apart as the spider can reach with the spinnerets on one and the front feet on the next, and so goes on nearly to the outside of the web, where it stops abruptly. The spider usually rests a moment and then begins, sometimes at another part of the web, the outer sticky spiral. In the outer-

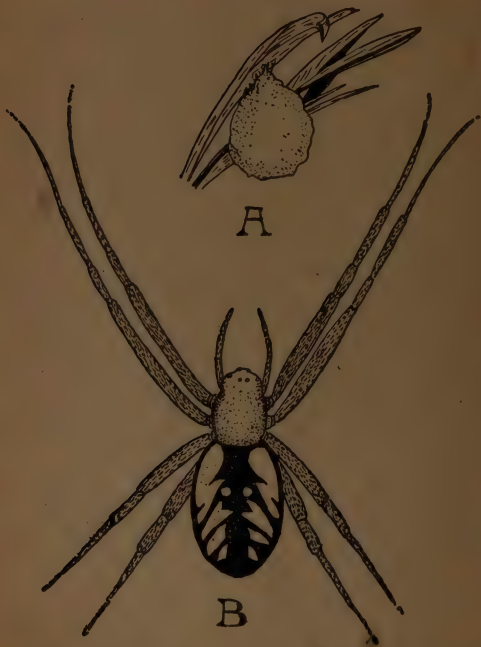


A, *Acrosoma spinea*, female; B, *Epeira stellata*.

most parts of the web it usually forms several loops, filling in the corners until it approaches the inner spiral and finds room to pass completely around the web. As soon as the inner spiral is found in the way a part of it is cut out, and by the time the outer spiral is finished the inner is reduced to the small and close portion near the center.

"While the temporary spirals are made as far apart as possible, the threads of the outer spiral are placed as close together as they can be without danger of their sticking to each other, and usually a little closer together toward the center of the web than they are at the outside. In fastening this thread to the rays of the web the spider first feels for the last thread with the first and second feet, and, having found it, turns the body slightly around and grasps the ray with the nearest foot of the fourth pair at a short distance from the point where the last thread crosses. After taking hold of the ray with the fourth foot, the spider turns down the abdomen so as to place the spinnerets against the ray and fastens the thread to it, at the same time holding the thread off with the other fourth foot, to prevent its sticking to anything around it. The whole making of the web seems to be done entirely by feeling and is done as well in the dark as in the daylight.

"When the spider is active and the food supply good, a fresh web is made every day, the old one being torn down and thrown away. In tearing down a web the spider walks out from the center on one of the rays and gathers in



Agriope riparia, the largest and showiest of the Epeiridae. A, egg-sac attached to rushes; B, adult female

what web he can reach with the front feet, chews it into a ball and drops it; then, having put in new rays in the cleared space, he goes to another part of the web and tears down another piece."

Epeira sclopetaria is the most common round-web spider abundant in houses, and is, in fact, seldom found elsewhere. It is distributed all over the northern part of the United States, and was probably imported from Europe. The web is usually spun at twilight, and the spider sits in the net all night, the day being passed in concealment, often at some little distance from the web. *Sclopetaria* is about one-third of an inch long, and the general color is a soft purplish brown, with faint yellow markings forming a complicated pattern on the abdomen. *Epeira strix* is a nearly related species in which the complex pattern on the abdomen is replaced by a wide scalloped median stripe, and there are three longitudinal marks on the cephalothorax. *Strix* is found in bushes and low trees as well as in houses, while *sclopetaria* seldom ventures far from human habitations.

Epeira angulata. This spider is about half an inch long, with two prominent elevations on the front of the abdomen. It is a woodland species, swinging its web often in the tops of large trees, and is colored to resemble bark or dead wood. The cephalothorax is dark brown, with vague black markings in the center. The legs are dark brown with black areas at the ends of the joints. The abdomen is brown, with an irregular black middle stripe and a yellow spot in front. The males are consider-

ably smaller than their mates, and have the front pairs of legs much longer.

Epeira insularis is the yellow spider so common in bushes and berry patches, spinning its web usually not more than three or four feet above the ground. Full-grown females measure nearly three-fourths of an inch in length, while the males are about half as large. The cephalothorax is yellowish-brown; the abdomen is large and oval, usually bright yellow in color; sometimes there is a complicated purple design on the back of the abdomen, particularly conspicuous in the female because of her larger size. The legs are brilliantly marked with yellow, brown and white bands. *Insularis* does not often lie in its web, but builds a shelter of leaves at a little distance, with a stout silken run-way leading from the shelter to the center of the net. Thus the spider is concealed from view until some insect blunders into the web, when it sallies out and deals with its prey as do the other members of the family.

Epeira trifolium is a much larger species, some individuals being more than three-quarters of an inch in length. The cephalothorax is white with several wide black bands; the legs are black with wide white rings, and the large round abdomen is usually purplish brown, although there is considerable variation, some specimens being nearly white. There are usually a number of light spots on the back of the abdomen, and it is the clover-shaped form of the largest of these which is responsible for the specific name. Says Emerton: "*Trifolium* makes a large web in bushes, but seldom stands



The web of *Epeira labyrinthica*, showing the irregular nest in the upper right-hand corner. This network is sometimes larger than the circular web, and contains the egg-sacs.

in it. It has near by a tent above the web made of leaves drawn together and lined with silk, connected with the center of the web by a strong thread, and it usually remains in this tent with one foot on the thread, so that it feels when anything is caught. The spiders mature in September, when the males may be seen loitering about the nests of the females. In October they lay their eggs and all die before winter."

Epeira labyrinthea is a little brown-and-white spider which seldom measures more than a fifth of an inch in length. It is interesting chiefly because it spins a double web. The upper web is a large loose affair of braces and cross-bars running in all directions, containing several egg-sacs and a nest in which the owner usually lies concealed; the lower structure is the typical neat round web of the Epeiridae. This round web is small—two or three inches in diameter—but the upper web may be seven or eight inches across. *Labyrinthea* is usually found among weeds or low bushes.

Epeira stellata is a brown spider about a third of an inch long, remarkable for the peculiar shape of the abdomen, which gives it a crab-like appearance. The abdomen is very large, partially concealing the legs, and is sharply pointed fore and aft. Besides these two large points, there are five smaller points on each side, and two more well forward on the back. The short legs are brown, with darker rings at the joints and at points half-way between the joints.

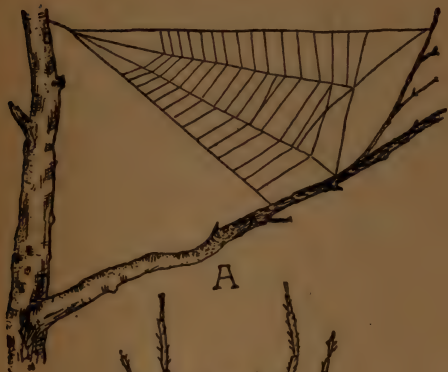
Epeira verrucosa measures only about a quarter of an inch, but appears somewhat larger because of the unusually long legs. The cephalothorax is light gray, and the abdomen is wide in front, narrowing very much toward the rear, and ending with several prominent tubercles. The back of the abdomen is almost covered by a large whitish-yellow triangular spot. There is a great difference between the sexes—the male has a very much smaller and more slender abdomen, the legs are longer and thinner, and there is a peculiar branching spine on the tibia of the second pair of legs.

Cyclosa conica. This is a gray and white spider about a quarter of an inch in length, and is easily recognized by a large conical hump at the rear end of the abdomen. The cephalothorax is nearly black, the legs white with numerous black bands, and there is usually a black stripe down the middle of the abdomen. The male is somewhat smaller than the female, and the abdominal hump is much less prominent. The web is rather large for the size of the spider, and is not exactly round, being always considerably wider than it is high. Another peculiarity is that there is a sort of silk ruffle through the web, full of the hard parts of insects, bits of leaves and other rubbish, and usually containing several egg-sacs as well. This band of debris is left in place each time the web is renewed, and the new web built around it. The spider seldom leaves the web, but sits in the center among the rubbish, from which it can hardly be distinguished as long as it remains motionless.

Acrosoma spinea is easily recognized by its large flat abdomen, ending in two large spreading horns behind, and overhanging the spinnerets by at least half its length. There is a smaller pair of points on the front of the abdomen, and another about the middle of the abdomen on either side. The general color is yellowish white, but there is a red spot at the base of each spine, and the points themselves are black. The cephalothorax and the first two pairs of legs are brown, the third and fourth legs are whitish, longitudinally striped with black. The male is much smaller than the female, and the spines are very short and blunt. The web is set at an angle, and has a small round hole in the center where the owner hangs suspended. If a very large insect blunders into the net, or if the bush or tree upon which it hangs is shaken, the spider usually drops to the ground and hides among the leaves until the danger is past.

Acrosoma rugosa is very much like the preceding species, except that there are five pairs of spines instead of three, the two additional pairs being located just under the tip of the abdomen. Another difference is that all of the spines are of approximately the same size. The male *rugosa*, however, has no spines or humps at all.

Argiope riparia is probably the largest, handsomest and one of the most familiar members of the Epeiridae—the large yellow and black spider which spins its web in low bushes from the end of July until cold weather sets in. Some specimens are fully an inch long, and



A



B

Hyptiotes cavatus, one of the so-called triangle spiders. A, common form of the web; B, adult female. Note the calamistrum on the hind legs, used to pull silk out of the spinnerets.

the front legs are considerably longer than the body. The cephalothorax is grayish; the abdomen is black with large yellow spots along the sides; the legs are black except for the femora of the three hinder pairs, which are yellow. The female spins a magnificent web about two feet across, with a wide white zig-zag band vertically through the center, and a stout silken platform upon which the spider rests at ease. Here she spends her entire time except when she is laying eggs in the large brown egg-sacs, which are attached to nearby grass or reeds. The male spider is only about one-third as large as the female; he builds himself a poor little make-shift of a web near that of his mate, and, it is said, sometimes invades her web in search of discarded food.

Tetragnatha extensa is a slender, straw-colored spider about three-eighths of an inch long, with very long front legs, and is easily identified by the characteristic attitude it assumes at rest in the web. It stands in the center with the legs extended forward and backward, close together except at the tips, where they are turned slightly outward. The mandibles of both sexes are very large, and the male palpi are fully one-half as long again as the cephalothorax. Some specimens are dull brown instead of straw-color, and sometimes there are several vague dark stripes on the abdomen.

THE CINIFLONIDAE

These differ from all other spiders in their peculiar spinning organs. Besides the six spinnerets common to the other groups, the Cini-flonidae are provided with a larger spinning organ called the *cribellum*, a flat, wide structure just in front of the other spinnerets. They have also on each hind leg a row of hairs known as the *calamistrum*, used in pulling loose ribbons of silk out of the spinnerets.

Uloborus plumipes spins a round web, and looks very much like a Tetragnatha as it hangs in the center, because of its narrow body and long legs. A little more than a quarter of an inch in length, the color is usually dark brown, although there is considerable variation, some specimens being almost yellow. The webs are usually a little inclined, and are particularly abundant among dead twigs in pine trees. There are usually three or four elongated egg-sacs, and these are strung together like sausages and fastened so as to form one of the horizontal radii of the web.

Hyptiotes cavatus is another member of the family which is fond of dead pine twigs as building sites. It is about one-sixth of an inch long, of a mottled brown color, and is recognized by the distinctive form of its web, which Emerton describes as follows: "The web consists of four rays crossed by a dozen or more threads. The point where the rays meet is attached to a thread which extends to the spider's roost, usually the end of a twig. Here

it holds on by the hind feet and draws the thread tight with the fore feet. When an insect strikes the web the spider lets go with the hind feet and is jerked forward by the contraction of the web, and slides along toward its center, where it finds the prey and takes it out of the web to its perch."

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 507 Richard Wagner: An Introduction. Goldberg.

(Note: In the operatic titles listed below, Mr. Theo. M. R. van Keler gives short biographical sketches, the story of the opera and helpful criticism of the music, illustrated by excerpts from the score.)

- 410 Die Walkure. Wagner.
 440 Cavalleria Rusticana. Mascagni.
 441 I Pagliacci. Leoncavallo.
 455 Richard Strauss's Salome.
 456 Carmen. Bizet.
 457 Lohengrin. Wagner.
 458 Tannhauser. Wagner.
 459 Das Rheingold. Wagner.
 494 Siegfried. Wagner.
 495 Rigoletto. Verdi.
 569 Gotterdammerung. Wagner.

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 174 Trial of William Penn.
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 201 Satan and the Saints. Tichenor.
 214 Speeches of Lincoln.
 286 When the Puritans Were in Power. Tichenor.
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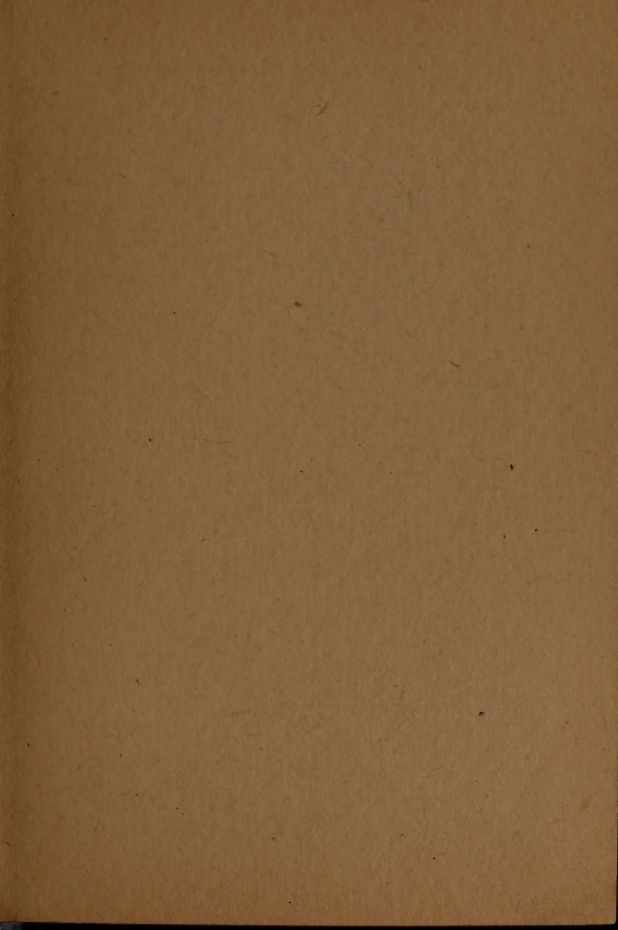
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 134 The Misanthrope. Moliere.
 229 Les Precieuses Ridicules. Moliere.
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 166 English as She Is Spoke. Twain.
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